

HYDROCARBON COMBUSTION IN A FLUIDISED BED

by

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ABSTRACT

The advantages of flameless combustion of premixed air and fuel in presence of solids, preferably when the solids are in a fluidised state are discussed. Literature survey on flameless combustion in presence of solids indicated that combustion proceeds by heterogeneous surface reaction (if the particles are catalytic) and/or by homogeneous reaction in the free space. In the present study, premixed air-LPG combustion in presence of solids with *and* without catalytic effect is studied.

Premixed air-LPG combustion kinetics below ignition temperature and in presence of pure copper oxide catalyst ~~was~~ *were* determined experimentally. Above the ignition temperature, the reaction rate in the free space has been assumed to be controlled by cracking step, *the* and cracking kinetics reported by Davis and Farrell [59] ~~has~~ *have* been employed for reactor modelling.

An experimental fluidised bed reactor for high temperature (up to 1273K) studies was designed, fabricated and assembled. Premixed air-LPG combustion studies were carried out at various flow rates and temperatures. The fluidised particles used were with *and* without catalytic properties. Depending on the temperature and the nature of the particles, the combustion reaction could be purely heterogeneous, purely

homogeneous or both simultaneously. Catalyst particles of two different densities were also used.

The pertinent characteristics of the fluidised bed reactor were reviewed along with the available fluidised bed reactor models. Comparison of observed conversions with the conversions based on simple two phase model was found to be unsatisfactory. Adopting the Dubble assemblage model approach of Wen and coworkers for heterogeneous reactions, a bubbling bed model was developed to account for both heterogeneous and homogeneous reactions and the estimated bed non-isothermality in the axial direction. This model was shown to predict the complete range of experimentally observed conversions in the fluidised bed.

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